Inquiry Lab: Fascinating Brine Shrimp Lesson Plan

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9th Grade Earth Systems

Utah State Curriculum connections:

Standard 4: Students will understand that water cycles through and between reservoirs in the hydrosphere and affects the other spheres of the Earth system.

Objective 2: Analyze the physical and biological dynamics of the oceans.

b. Determine how physical properties of oceans affect organisms (e.g., salinity, depth, tides, temperature).

Intended Learning Outcomes:

- 1a. Observe objects, events and patterns and record both qualitative and quantitative information.
- 1e. Plan and conduct experiments
- 1h. Construct models, simulations and metaphors to describe and explain natural phenomena.
- 6h. Understand that scientific inquiry is characterized by a common set of values that include logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results and honest and ethical reporting of findings. These values function as criteria in distinguishing between science and non-science.

Time required: two days for set up, observation time (a few minutes) for several days, and one day for completing the lab report.

Guided Inquiry Lab Objective: To help students become acquainted with the complexity of living organisms and the conditions needed for survival through the hatching of brine shrimp.

Prior Knowledge and Introduction to Inquiry Lab:

- Review the typical steps in the Scientific Method, the importance of keeping careful records when doing an experiment, and the importance of testing only one variable at a time while keeping all others constant.
- Review graphing, dependent and independent variables, and data tables.
- Students will need to know something about brine shrimp and the conditions necessary for life before they begin this lab. This can be done through individual internet research or teacher driven discussions (helpful web sites listed at the bottom of this lesson plan).

Procedure:

Step 1

- a. Allow students to choose a partner or assign partnerships.
- b. Have a classroom discussion about how scientific inquiry is performed
- c. After a discussion or student research on brine shrimp, have teams brainstorm three possible problems that may impact the hatching or growing of brine shrimp that they would like to investigate. (Salinity levels, temperature, acidity, light, pollutants...)
- d. Have teams narrow their questions to the one they would like to investigate.
- e. Students will then write a prediction stating what they think will occur.
- f. Determine a relevant title for your inquiry.
- g. Have student design an experiment, meticulously write the steps, and turn in a list of materials needed to the teacher. (Have designs checked off with the teacher).

Step 2

- a. Have students set up their experiment. Encourage them to record any possible errors that may arise, explain how they may impact results, design a data table to organize observation, and determine how you will measure the outcome.
- b. For the next several days (4-5), have student take a few minutes of class time to make careful observations and record findings in a data table.

Step 3

Analyze the data from the data table. Does data support the prediction? What conclusions/inferences can be made based on the data? Graph class data on graph paper. Remember that the independent variable, the one you are manipulating or changing (salinity, temperature, acidity, light, pollutants) goes on the X-axis and the dependent variable, the one that changes because of the manipulation, goes on the Y-axis (number of brine shrimp).

Step 4

Write up a comprehensive lab report. Be sure to include the following information:

- A title for the inquiry lab
- A question to be tested
- A prediction of the outcome
- Steps used in the experiment
- Analysis of the data
- A titled and labeled graph and explanation of the results graphed
- Conclusion that compares findings with the prediction, observations made, possible unplanned variables, and changes that could be made to make this experiment better.

Source: April J. Cleveland, 1998, for Science Junction at North Carolina State University. (Fair use guidelines apply) www.ncsu.edu/sciencejunction/terminal/lessons/brine.html

See the following website for more detailed agenda and a possible grading rubric. www.ncsu.edu/sciencejunction/terminal/lessons/brine.html

Name		
		Period
	Date	

Inquiry Lab: Fascinating Brine Shrimp

You and a partner will be designing and carrying out an experiment to test the conditions and environment needed to hatch brine shrimp or the conditions needed to keep them alive. Before you can develop a valid hypothesis, research some background information on brine shrimp and the physical environment required for life. Attach a sheet of paper that includes ten facts that may be important for your investigation.

Day 2

Now that you have completed some research on brine shrimp, choose a topic to investigate, ask a question, and then develop a hypothesis. (Possible things to think about: temperature, salinity, acidity, light, pollutants for optimal hatching or food, salinity, temperature, sunlight to maintain life)

State the problem to be investigated:

Prediction of the outcome:

Designing the experiment:

Your experiment should include the following:

- A carefully thought out procedure that tests only one variable and keeps all others constant
- An investigation that tests the prediction
- A thorough description of the procedure
- Possible sources of errors or problems
- A way to measure your results
- A data table to record at least five days of observations
- A drawing of the set-up of your experiment
- A list of supplies needed

Attach a diagram (labeled picture) show the design of your experiment

Record data: Check your investigation each day for at least five days and record observations in your data table. *Attach your data table to this lab sheet.*

Analyze and graph your results. Determine the type of graph that will best represent all recorded data from your class. Carefully graph your results--include a descriptive title and label axis'. Make sure you include a summary of what your graph shows. *Attach your graph and summary.*

Conclusion: In scientific language, write a conclusion that is supported by the evidence and data you collected. Make sure to compare your prediction to your conclusion, include possible errors that may have altered your findings, and list the things that might need to be changed to make your investigation more accurate.

Grading:

Reflect on your investigation, the critical thinking that went into designing your experiment, and the amount of effort put forth. Self-grade this project.

Self-grade:	rade:		Peer/teacher grade:	
/ 5	Ten facts about brine shrimp	/ 5	Ten facts about brine shrimp	
/ 5	Propose a testable idea and identify variables	/ 5	Propose a testable idea and identify variables	
/5	Diagram/explanation of experiment	/5	Diagram/explanation of experiment	
/ 5	Completed data table	/ 5	Completed data table	
/ 5	Graph (labeled, and summarized)	/ 5	Graph (labeled, and summarized)	
/15	Conclusion	/15	Conclusion	
/10	Effort	/10	Effort	
/50	TOTAL POINTS	/50	TOTAL POINTS	
	/50	Final Grade		

Teacher Page

Hatching container made from one 2 liter clear pop bottle.



Helpful hints:

- Use non-iodized salt
- A good concentration is 1 ½ Tablespoon salt to one quart water
- Use very small amount of brine shrimp eggs less that 1/16 teaspoon will work
- Optimum pH levels a bit higher than 8.0 is recommended
- Optimum hatching temperature is 80-82° F (will hatch at cooler temperatures)
- Sunlight is necessary to trigger the hatching
- Incubation period is generally 24 36 hours.
- To maximize hatching percentage, swirl the water inside the hatching container to knock down eggs that have been stranded on the sides of the container once or twice in the first few hours
- Feed your brine shrimp a very small amount (a few drops) of baker's yeast that has been reconstituted
- For more helpful hints go

to: www.ncsu.edu/sciencejunction/terminal/lessons/brine.html